EXAMINER'S AMENDMENT

1. The Art Unit of your application in the U.S.P.T.O. has changed. To aid in correlating any papers for this application, all further correspondence regarding this application should be directed to Art Unit 2483.

2. An examiner's amendment to the record appears below. Should the changes and/or additions be unacceptable to applicant, an amendment may be filed as provided by 37 CFR 1.312. To ensure consideration of such an amendment, it MUST be submitted no later than the payment of the issue fee.

Authorization for this examiner's amendment was given in a telephone interview with Ronni S. Jillions on 8 November 2010.

The claims are amended as follows:

Claim 15 is amended to read:

15. An apparatus for tracking moving objects in time-series pictures, comprising:

a non-transitory storage device for storing the time-series pictures and a program;

and a processor coupled to the storage device, wherein the program makes the processor read and process the time-series pictures to track the moving objects in the pictures, and by the processing, each picture is divided into blocks, each block

consisting of a plurality of pixels, in a case where an object-identification code of a moving object is assigned in a block unit ~~of block~~, and a motion vector of a moving object is determined in a block unit ~~of block~~, and wherein object-identification codes of a plurality of moving objects on a picture at a time t1 [[has]]have been determined, and the program enables the processor to perform the steps of:

determining each object-identification code and moving vector as approximate values of each of the blocks on a picture at a time t2 on the basis of a first estimation function, and determining a value of a second estimation function using the approximate values;

determining each object-identification code and moving vector as a solution of each of the blocks on the basis of an approximately-optimum sum of the first and second estimation functions, wherein the approximately-optimum sum is obtained by changing the approximate values within a given range;

wherein the first estimation function has the sum of a sub-estimation function for determining a moving vector by block matching between a current block on the picture at the time t2 and a region on the picture at the time t1 and a sub-estimation function for determining an object-identification code of the

current block on the basis of a count of pixels belonging to the same object-identification code within the region,

wherein the second estimation function includes respective absolute values of differences between the motion vector MV between the current block and the region and a motion vector of each of the blocks around the current block, each of the blocks having the same object-identification code as that of the current block, and takes a more optimum value when the sum of the absolute values is smaller.

The following new claims are to be added:

44. The apparatus according to claim 15, wherein the second estimation function includes $\Sigma|MV - MV_{neighbor}| / L$, where $MV_{neighbor}$ denotes a motion vector of a block having the same object-identification code ID of the current block within blocks surrounding the current block, Σ denotes a sum over the blocks having said same object-identification code ID, and L denotes a number of the blocks having said same object-identification code ID.

45. A method of tracking moving objects in time-series pictures by processing the pictures using a processor, each picture being divided into blocks, each block consisting of a plurality of

pixels, wherein a case where an object-identification code of mobbing object is assigned in a block unit, and a motion vector of a moving object is determined in a block unit, and wherein object-identification codes of a plurality of moving objects on a picture at a time t1 have been determined, in which the method using the processor comprises the steps of:

determining each object-identification code and moving vector as approximate values of each of the blocks on a picture at a time t2 on the basis of a first estimation function,

determining a value of a second estimation function using the approximate values; and

determining each object-identification code and moving vector as a solution of each of the blocks on the basis of an approximately-optimum sum of the first and second estimation functions,

wherein the approximately-optimum sum is obtained by changing the approximate values within a given range;

wherein the first estimation function has the sum of a sub-estimation function for determining a moving vector by block matching between a current block on the picture at time t2 and a region on the picture at the time t1 and a sub-estimation function for determining an object-identification code of the

current block on the basis of a count of pixels belonging to the same object-identification code within the region,

wherein the second estimation function has the sum of a sub-estimation function for determining a moving vector by block matching between a current block on the picture at the time t2 and a region on the picture at the time t1 and a sub-estimation function for determining an object-identification code of the current block on the basis of a count of pixels belonging to the same object-identification code within the region,

wherein the second estimation function includes respective absolute values of differences between the motion vector MV between current block and the region and a motion vector of each of the blocks around the current block, each of the blocks having the same object-identification code as that of the current block, and takes a more optimum value when the sum of the absolute values is smaller.

46. The method according to claim 45, wherein the second estimation function includes $\Sigma|MV - MV_{neighbor}| / L$, where $MV_{neighbor}$ denotes a motion vector of a block having the same object-identification code ID of the current block within blocks surrounding the current block, Σ denotes a sum over the blocks having said same object-identification code ID, and L denotes a

number of the blocks having said same object-identification code ID.

47. An apparatus for tracking moving objects in time-series pictures, comprising:

a non-transitory storage device for storing the time-series pictures and a program;

and a processor coupled to the storage device, wherein the program makes the processor read and process the time-series pictures to track the moving objects in the pictures, and by the processing, each picture is divided into blocks, each block consisting of a plurality of pixels, the program comprising the steps of:

(b1) determining motion vectors of respective blocks in a picture at a time t2 through the use of block matching between a picture at a time t1 and the picture at the time t2, without discriminating between the background image and moving objects;

(b2) determining motion vectors of blocks which are not determined at the step (b1) by estimating the motion vectors through the use of the method according to any one of claims 45 or 46; and

(b3) assigning the same identification code to adjacent blocks if an absolute value of a difference between motion vectors of the adjacent blocks is less than a predetermined value.

48. A method according to any of claims 45 or 46, wherein a background image is regarded as a moving object.

49. A method of tracking moving objects in time-series pictures with processing the pictures by a processor, the method using the processor comprising the steps of:

(a) dividing each picture into blocks, each block consisting of a plurality of pixels; and

(b) with regarding a background image as a moving object, assigning an identification code of moving object in a block unit and determining a motion vector of the moving object in a unit of block;

wherein the step (b) comprises the steps of:

(b1) determining motion vectors of respective blocks in a picture at a time t2 through the use of block matching between a picture at a time t1 and the picture at the time t2, without discriminating between the background image and moving objects;

(b2) determining motion vectors of blocks which are not determined at step (b1) by estimating the motion vectors through

the use of the method according to any one of claims 45 or 46; and

(b3) assigning the same identification code to adjacent blocks if an absolute value of a difference between motion vectors of the adjacent blocks is less than a predetermined value.

50. An apparatus for tracking moving objects in time-series pictures, comprising:

a non-transitory storage device for storing the time-series pictures and a program;

and a processor coupled to the storage device, wherein the program makes the processor read and process the time-series pictures to track the moving objects in the pictures, and by the processing, each picture is divided into blocks, each block consisting of a plurality of pixels, a plurality of object maps of different times have been stored, each object map having motion vectors of the moving object in a block unit, the program comprising the steps of:

(a) determining respective motion vectors of first and second regions adjacent to each other on one at time t1 of the plurality of object maps; and

(b) determining respective motion vectors of two regions, to which the first and second regions are moved with using the determined motion vectors, respectively, in a positive or negative direction thereof, on the basis of an object map at a time corresponding to completion of the movement of the regions,

wherein step (b) is repeated a plurality of times to track, until a time t2, the two regions corresponding to the first and second regions,

wherein the first region at the time t1 is a single cluster including adjacent blocks, and

wherein at step (a) or step (b), for each current region of the two regions, a weighted motion vector average is determined as a motion vector of the current region using motion vectors of blocks overlapping the current region, where weights given to the respective motion vectors correspond to the number of pixels of respective portions overlapping between the respective blocks and the current region,

the program further comprising the steps of:

obtaining a motion vector from the first region at time t1 to the corresponding region at time t2 as a first fast-forward motion vector by accumulating corresponding motion vectors between the times t1 and t2, obtaining a motion vector from the second region at time t1 to the corresponding region at time t2

as a second fast-forward motion vector by accumulating corresponding motion vectors between the times t1 and t2;

recognizing the first and second regions at the time t1 as different moving objects if an absolute value of the difference between the first and second fast-forward motion vectors is more than a predetermined value; and

if a plurality of peaks are present in a histogram of absolute values of motion vectors of the blocks, determining an interval between the times t1 and t2 on the basis of a speed difference between the peaks.

3. The following is an examiner's statement of reasons for allowance: Claim 15, previously allowed, is amended to correct minor informalities. New Claim 44 is equivalent to now-cancelled Claim 16 in a form that overcomes the only adverse action in the previous Office action. New Claims 45–49 are equivalent to now-cancelled claims 13, 14, 21, 40, and 41, respectively, correcting minor informalities, previously rejected only under 35 U.S.C. § 101 based on a now-repudiated interpretation of Bilski v. Kappos, 130 S.Ct. 3218 (2010). Claim 50 is equivalent to now-cancelled Claim 36, previously found allowable but objected to as dependent on a rejected parent base claim, and its parent base Claim 43. As such, all subject matter found allowable over the prior art is re-captured, giving Applicant the full rights to which the Office has deemed them entitled under law.

Any comments considered necessary by applicant must be submitted no later than the payment of the issue fee and, to avoid processing delays, should preferably accompany the issue fee. Such submissions should be clearly labeled "Comments on Statement of Reasons for Allowance".

Conclusion

4. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. U.S. Patent Application Publication No. 2003/0161399 A1 ("Ali") teaches an encoder that segments an image into regions based on block motion vectors.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to DAVID N. WERNER whose telephone number is (571)272-9662. The examiner can normally be reached on Monday-Saturday from 10:30 to 5:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Joseph G. Ustaris can be reached on (571) 272-7383. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for

published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/D. N. W./
Examiner, Art Unit 2483

/Joseph G Ustaris/
Supervisory Patent Examiner, Art Unit 2483